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Arbitrage possibilities on the ex-dividend day
-A study on the ex-dividend day stock price behavior on the Swedish Stock market.

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Abstract

In this paper we have investigated the ex-dividend stock price behavior on the Stockholm Stock Exchange to see if there are any arbitrage trading possibilities in connection with the ex-day. Our data sample consisted of all Swedish stocks that paid out a cash dividend during the period 1994-1998 which amounted to 837 observations.

We can conclude that there in fact are arbitrage possibilities since the price correction has on average been less than the dividend paid out. The OTC market is the market where the biggest arbitrage possibilities exist.

In 1994 taxes on dividend were zero and that attracted short-term traders who determined the price setting on the ex-day and therefore the price fall was closer to the dividend. In 1995 the taxes on dividends and capital gains were set equal and as a consequence the price correction ratio was significantly lower which indicates that the price determination was now dominated by long-term investors who trade on other issues than the dividend.

We can also conclude that there was a Clientele Effect on the ex-dividend day in the sense that higher dividend yield stocks attracted more short-term traders than the low dividend yield stocks.

We found no significant differences for the ex-day effect for those companies that that are cross-listed on both the New York Stock Exchange and Stockholm's Stock Exchange compared to those only listed on the Stockholm Stock Exchange.

Key words: Ex-dividend day, arbitrage, dividend, short-term trading, long-term trading, market efficiency and Stockholm Stock Exchange.

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1. Introduction

1.1 Background

Within recent years there has been increased stock market efficiency as more information is available and easier to attain about the companies and their stocks as well as market factors such as interest rates and inflation etc. New types of media, for example the Internet, have become available to most people and have made the trading process cheaper and less difficult. The available possibilities to make abnormal profits, which mean the return to a portfolio in excess of the return to a market portfolio (Copeland & Weston 1992), have thereby decreased. This has caused investors to try to find new areas to place their money in order to maximize the return on their investments with as low risk as possible. A new focus has now been placed on looking for areas where the market efficiency does not hold and arbitrage possibilities are available. Even though the absence of arbitrage is a necessary condition for market equilibrium and efficiency, there are still fields where it can and has been found to exist.

The number of people interested and actively trading on the stock market has also grown tremendously. Only in Sweden, more than half of the population is currently a stockowner of some kind (Ekonomi Fokus, 1997). Even though the direct ownership of stocks has decreased, more people in Sweden own stocks and save through mutual funds. This has caused a need for finding investment opportunities before others do and it becomes an active market, instead of just waiting for opportunities to appear, as the increased efficiency results in the possible opportunities disappearing as soon as they are noticed.

Other issues, such as taxes, transaction costs, and various laws related to making investments also make investment opportunities vary among different markets. Taxes differ between countries and activities and depending on where you are conducting your business, different

opportunities might be available on where to place the investments. Sweden has had a remarkable change in its tax policies concerning dividends and capital gains during recent years, where it has moved between being extremely high and very low, even all the way down to zero for the dividend. Therefore the possibilities to make abnormal profits on the stock markets might have changed as well.

During the 1980s there have been a few easily identifiable time periods when the stock returns were different from the usual returns (Claesson, 1987). This has opened the market for making arbitrage profits where you can make money with low risk. An area where arbitrage profits[1] has been present is when a stock goes ex-dividend, which will be the central theme and area of investigation in this thesis.

The ex – dividend day effect is concerned with the issue that stocks yield deviates from the normal yield during the period around the ex – dividend day. This is an area which has been broadly investigated[2] and concerns the issue of whether or not the fall in the stock price is the same as the amount of the dividend between the last day of buying the stock with the right to dividend and the first day when the buyer no longer has any right to the dividend, namely the ex-dividend day.

Another area, which is of interest as investments in today's society are largely on a worldwide basis, is whether there are any discrepancies in the efficiency between different stock markets. This is because more focus and attention might be placed on stocks on a bigger market with more investors than a smaller market and therefore the efficiency and correction in the

[1] Even if the stock price drop was less then the amount of dividend paid out, there would not be an arbitrage profit since it is not a risk free profit. We do not know beforehand what the actual price drop will be. Sometimes it is higher than the amount paid out and at other times it will be lower (Jarrow & Heath, 1988). Arbitrage by definition means a risk free profit and this is not the case here. We have still chosen to use this arbitrage term because it is the common expression in the literature when the ex-dividend day effect is discussed.

[2] For example: Elton & Gruber 1970, Kalay 1982, Lakonishok & Vermaelen 1983, Koski 1996, Claesson 1987, De Ridder & Sörensson 1995, Eades et al 1984 and Grinblatt et al 1984.

stock price might work better in stocks listed on the market with more active trading.

1.2 Purpose

The main purpose of this thesis is to examine the ex-dividend stock price behavior of the Swedish stock market between the years 1994 - 1998 and to see if there do exist any possibilities to make arbitrage profits in connection with the ex-dividend day. We will collect and examine the data on Swedish stocks listed on the Stockholm's Stock Exchange during this five-year period and see if the stocks actually fall by the same amount as the dividend on the ex-dividend day. One sub purpose is to make a comparison between the Swedish stocks which are cross listed on US stock markets and stocks only listed in Sweden to see if there are any differences between how the stock price reacts on the ex-dividend day. Another sub purpose is to make a comparison between the different markets that exist on the Stockholm Stock Exchange.

1.3 Problem analysis

In an efficient capital market the stock price fully reflects the available information (Ross, Westerfield and Jaffe, 1993). Many investors operating in the stock market live and act based on the same principle. The idea that everyone tries to follow is that one should acquire stocks when the price is low and sell them later when the price is higher. This makes an assumption that there are undervalued stocks available in the market, which contradicts the basic idea of an efficient market that states that this cannot be possible in order for a stock to behave efficiently. In fact, in an effective capital market there should not be any inaccurately valued stock prices available (Copeland & Weston 1992).

According to Claesson (1987), past empirical studies that have been made on different stock markets draw a picture, which shows that the stock

market is a good example of an effective market. Because of the nature of the stock market there are several reasons to assume that the stock market is more efficient than other areas where efficiency is an issue. The most important reason for this is the extensive amount of information that is available, both about the company that has issued the stock and the information about the stock price itself. In order to be instantly reflected in the stock price, the company information is being spread with a speed that no other information can come close to.

What importance does it have if the stock market is effective or not? The stock market is a part of the capital market and its purpose is to distribute capital from savers to investors that have investment possibilities. In order for both these parts of a transaction to receive the best possible return on their investments, market efficiency proves to be a required criterion. It is therefore in the society's best interest if this distribution among parties operating in the market is done as effectively as possible.

There are many different definitions of efficiency but one should understand that when referring to the efficiency in a market, it is actually the efficient spread of information that is being discussed. When talking about the behavior of a stock on the ex-dividend day, it has been shown that there are some differences in the theory of how a stock should behave in an efficient market and how it actually behaves in real life. The stock price should, if the market efficiency theory is true, fall by the full dividend amount on the ex-dividend day. If the stock price fell by either more or less than the dividend amount, there would be arbitrage possibilities. The most reasonable explanation for the ex-dividend effect is that it is a reaction to the final confirmation that the dividend will be paid out. Before this date it is not determined that the dividend payout will happen and cancelled dividends have occurred in both Sweden as well as in America.

The ex-day effect is (as other effects) a market inefficiency only if there are no economic factors that can explain the abnormal returns. If there are

none, the returns surrounding the ex-date should not differ from the normal expected daily returns. This is the underlying hypothesis in a study of the ex-day effect as evidence against the efficient market hypothesis. The ex-day effect is not, according to Claesson (1987), economically important because the abnormal returns are small and limited to a short period. However, she points out that the importance for professional investors might be much greater. In real life there are in fact many stockbrokers and investors who actively trade and make their living on the ex-day effect (John Knopf, 1999).

The level of taxes on dividends and capital gains are important as differences between them attract different kinds of investors. Elton & Gruber (1970) pointed out that investors would hold different portfolios depending on the marginal tax rate. The taxes in Sweden have varied during the years of the study and the ex-dividend day effect should change along with the taxes. This makes the ex-dividend investigations in Sweden more interesting because we can look at two different tax systems and compare them to each other.

Efficiency levels in different countries may vary as well. What happens with the stocks on for example the US market does not necessary have to be the case on the Swedish Stock Market. Many Swedish companies cross-list their stocks on several exchanges and are therefore liable to what happens on both markets. This attracts foreign investors who face other tax levels to trade with Swedish stocks and the price correction could therefore be different. By examining the stocks which are cross-listed in US with the ones which are only listed in Sweden irregularities between these might be found.

Several investigations about the ex-day effect have been performed before[3]. Most of these studies have focused on the abnormal returns on the days

[3] For example: Elton & Gruber 1970, Kalay 1982, Lakonishok & Vermaelen 1983, Koski 1996, Claesson 1987, De Ridder & Sörensson 1995, Eades et al 1984 and Grinblatt et al 1984.

surrounding the ex-day. We are focusing our interest on the actual ex-dividend day to find out if there are arbitrage profits to be made. Another issue that is interesting to investigate is that if there is a difference between these, does that mean that the market is inefficient or is it due to other factors such as different tax-laws? This gives us our main research questions:

Are there arbitrage profits to be made on the ex-dividend day?

This is the main problem that is going to be examined in our thesis as it might prove to be profitable if patterns do exist where the market efficiency theory does not hold.

If yes, is the market inefficient or can the difference between the dividend and the stock price drop be explained with by other factors such as tax laws?

If there are any patterns in our analysis that look like showing arbitrage patterns, it is important to investigate if they depend on other markets factors such as taxes etc. or if they really present an opportunity for the investor to make profits on.

Is there a difference between the arbitrage possibilities on the ex-dividend day in stock listed only in Sweden and stocks that are cross-listed on the stock market in USA? Is there any difference between the different stock markets within the Stockholm Stock Exchange?

By examining this relationship it will be noticed whether or not there are any differences in the efficiencies between stocks listed on a large and very active market such as the NYSE and a smaller market, which in this case is represented by the Swedish Stock Exchange. Within the Swedish Stock Exchange there are also different markets containing different stocks.

These are the A-market, O-market, and the OTC-market and one of our questions in this paper is if there is a difference between these.

1.4 Delimitation

This thesis will not examine the ex-dividend day effects between the different branches that exist on the Stockholm Stock Exchange. It will not include foreign stocks listed in Sweden. Exceptions from this are the stocks Nokia, which is consider to be a Swedish related stock, and Autoliv Inc. and Pharmacia & Upjohn which have been Swedish for part of the period examined. Other markets than the A, O and OTC-markets will not be examined.

2. Theory and Earlier Research

This section of the thesis will go deeper into explaining past studies that have been made on the ex-dividend day effect and to combine this with the theories that exists about dividends. A special focus will be on the ex-dividend day and the factors surrounding this and to show what impact this will have on our study. This will give a clearer view of the subject and be used to compare with when performing our actual investigation in a later part of this paper.

2.1 Market Efficiency

The efficient-market hypothesis (EMH) predicts that the morning's press releases will be reflected in the stock price by that same afternoon (Ross, Westerfield and Jaffe, 1993). The EMH has implications for both investors and firms. First, because information is reflected in prices immediately, investors can only expect to obtain a normal rate of return. Awareness of the information when it is released does not give the investor any advantages. This is because the price adjusts before the investor has time to trade on it (ibid.). Second, firms should expect to receive the fair value for

securities that they sell. Fair means that the price they receive for the securities they issue is the present value. This means that there are no opportunities for valuable financing by fooling investors in an efficient capital market (ibid.).

Information is often classified in to three categories concerning response rates: information on past prices, public available information, and all information.

In an effective market it should not be possible for an investor to increase his expected return by collecting and analyzing information about the stock companies. This goes for both technical analysis, where the historical stock prices are studied for the purpose of finding trends and patterns to determine future stock price developments, and fundamental analysis, where the information that is published by both the companies themselves and by the press is studied. All available information should already be reflected in the stock price.

One common misconception is that all information is irrelevant and that investors randomly choose what stock to invest in. One should be aware that the only thing the hypothesis about an efficient market says, is that all available information is reflected in the stock price. The hypothesis does not say anything about how the market decides on the stock price, and thereby its return. Different stocks can have different expected returns even in an efficient market. If one believes that the differences in returns do not depend on coincidences but in fact on the differences in companies' abilities, then it is a good idea to keep up with the information flow (Claesson, 1987).

This thesis will be based on the fact that the stock market is semi-strong efficient. A market is semi-strong form efficient if prices reflect not only past prices, but also all public available information such as published accounting statements for the firm as well as historical price information.

No investor should be able to make above normal profits from trading rules, which are based on any publicly available information. The other two forms of market efficiency are the strong form and the weak form of efficiency, which cannot be considered to be very credible. Its hard to believe that somebody who has access to inside information will not be able to profit by this as assumed in the strong form efficiency. The weak form does not apply either as a good representative of the stock market since it does not consider information about the future such as growth in expected earnings etc.

2.2 Dividend

A dividend is a distribution by a corporation to its stockholders on a pro rata basis. Dividends can take four forms: cash, property, scrip (promissory note to pay cash), or stock dividends (Weygandt, Kieso, and Kell 1996).

The firm has various possibilities on how to use the cash they have acquired from past operations. By maintaining and allocating it efficiently they can ensure that the best value of their company is sustained while at the same time possibilities where investors can make profits might take place.

A firm's available cash comes from two sources – internally generated financing and new external financing. Once cash is on hand, it has three general uses: First, ongoing operations must be maintained. These include paying salaries, the cost of materials, taxes etc. The remaining funds are then available for one of two other purposes: expansion (either through expansion or acquisitions) or distribution to the firm's stockholders (Pinches, 1996). The distribution to stockholders can then be done in three different ways. First and most direct it is done by a cash dividend, secondly the firm can repurchase stock and the third way is by stock split or stock dividend (ibid.). Repurchases are allowed in Sweden but a company that wishes to do this first has to cancel the stocks which is very expensive and

also takes time. Because of this repurchases are not an attractive choice but it has occurred. After January 2000, companies in Sweden can repurchase stocks without following this procedure and then maybe this choice of method will be more commonly used. Which of these methods the firm chooses to use to distribute their excess cash to stockholders depends on several issues such as the signaling effect etc.

Cash dividends will be the focus of this paper as it is the form of dividends that affect the actual stock price and causes the value of the firm to differentiate. The common dividend procedure in Sweden is to pay out dividends once a year. Other markets have different forms of dividend payout procedures, such as the US market where the common praxis is to pay out dividends quarterly. This causes the area of investigation each year to be quite small for the Swedish market as it only is concerned with one time period each year. However, it does provide an easier base for investigation, as the dividend paid is usually bigger since it only occurs once a year and therefore the stock price reaction is bigger as well.

For the cash dividends to occur the board of directors must have declared dividends. The board of directors has full authority to determine the amount of income to be distributed in the form of a dividend and the amount to be retained in the business. Dividends do not accrue like interest on a note payable, and they are not a liability until declared. A cash dividend would bring with it a decrease in total stockholders equity or total assets.

According to the Lintner's Model, the dividend in the coming year would equal a constant proportion of earnings per share (Brealey and Myers 1984). This means that a firm that always stuck to its payout ratio would have to change its dividend whenever earnings changed. This is not the case in real life as, according to Lintner's Study, managers believe that shareholders prefer a steady progression in dividends. This means that even if the company were to give out a large dividend, they would only move

part way towards their target payment. The more conservative the company, the more slowly it would move towards its target and therefore the adjustment rate would be lower. This means that the dividends depend both on the dividend paid out the year before as well as the current earnings. We would therefore be able to describe dividends as a weighted average of past earnings (Ibid.).

Corporations can shift the money meant for dividend into capital gains by changing their dividend policies. In many countries dividend is more heavily taxed than capital gains, which explains why investors in high tax brackets might prefer this. This thesis will go further into discussions about the current tax laws in Sweden in a later section of this paper.

2.3 Dividend policies and payment procedures

There is no consensus on which dividend policy that is optimal and therefore there is not a definite connection between the stock price and the dividend level. One assumed connection exists according to which the dividend level in the long run depends on the rate of return. If the dividend grows faster than the rate of return, then the equity will be carved out and the solvency will thereby decrease (Aktiespararnas handbok, 1995).

There are several different theories that try to explain causes and reasons for certain dividend levels. For example: *Modigliani and Millers Irrelevance argument (1961), the Bird in the hand" theory by Gordon (1959), the Tax preference theory, the Signaling effect and the Client effect by Modigliani and Miller (1961), the Residual theory and the Constant dividend theory.* These studies try to explain why different kinds of dividends are distributed and why the models are used.

However, whether or not the dividend policy matters for the value of the common stock, firms do pay out dividends. The dividend payment

procedure consists of 4 steps; declaration date, ex-dividend date, record date and date payable (Pinches, 1996).

The declaration (or Announcement) date is the date when the board of directors meets and issues a statement declaring the cash dividend (ibid.). This is when the board of directors formally declares the cash dividends and announces it to its stockholders. The declaration of a cash dividend commits the corporation to a binding legal obligation that cannot be rescinded (Weygandt, Kieso and Kell 1996).

The ex-dividend date is an arbitrary date established for the convenience of the securities industry. It is the second business day preceding the record date as fixed by the firm. This date is established so that the firms are able to obtain an accurate determination of all stockholders by the record date. All shares owned before the ex-dividend date will receive the cash dividend. Owners of stocks that are purchased on or after this date will not be entitled to the next cash dividend because they will not be listed as owners of the stocks on the record date (Pinches, 1996).

The record date is the date that the stockholders' books are closed to determine whom the current stockholders of outstanding shares are for dividend purposes (ibid.). The stockowners listed as owners of the company's stock on the record date have the right to dividend. The time interval between the declaration date and the record date enables the corporation to update its stock ownership records. Between these two dates the number of shares outstanding should remain the same. Thus, the purpose of the record date is to identify the persons or entities that will receive the dividend, not to determine the amount of the dividend liability (Weygandt, Kieso and Kell 1996).

The payment date is as the name suggests the date when the firm mails the dividend checks to its common stockholders and the payment of the dividend is recorded.

2.4 Ex-dividend Day

The ex-day means that something is for sale without the right to a certain benefit. When talking about dividend, the ex-dividend day is the first day that the buyer of a stock buys it without the right to the current dividend. That means that as of the ex-dividend day that new owner does not have any right to receive that years dividend from the stock he buys. The ex-dividend day effect which will be discussed in this thesis will be considering the difference between the cum-dividend day, which is the last day to buy with a right to dividend, and the next day which will be the ex-dividend day and to see if there are any differences between the price drop in the stock price and the dividend between these two days. In Sweden it is a common praxis that the ex-dividend day occurs the day after the shareholders meeting whereby there might be other issues affecting the stock price on this day. However, this is not always the case and there are companies which have their ex-dividend day on another date.

The ex-dividend day has been studied for quite a while but the issue called the ex-day effect was only discovered quite recently (Claesson 1987). Many authors have discussed and written about ex-dividend but the first authors to give out a published paper concerning the so-called ex-day effect on the days surrounding the ex-dividend day were Eades, Hess & Kim (1984) and Grinblatt, Mausulis & Titman (1984). Earlier papers have looked at the ex-dividend day itself (i.e. Elton & Gruber (1970) and Kalay (1982)). These earlier papers discussed the clientele effect and tried to identify the marginal investors tax rate and not the ex-day effect.

Eades, Hess and Kim (1984) examined the ex-dividend day returns on several taxable and non-taxable distributions on NYSE for the period between 1962 and 1980. They found that these distributions exhibited abnormal return behavior for several days surrounding the actual ex-dividend day and that there was no possible explanation that was capable of

explaining the anomaly that was found in the study. Their study was based on performing an ex-dividend day experiment with taxable distributions to preferred stocks, non-taxable distributions to common stocks, and stock dividends and splits. Their findings were the first reason why the ex-dividend day behavior was noticed and further studied after this study. While performing their investigations they found that the taxable preferred stock dividends were priced as if the capital gains had a higher tax than dividends which often is not the case and more often the opposite (except for Sweden). Non-taxable cash distributions were also priced as if they impose negative taxes on the receivers. Their examination was based on the pricing behavior for five days on each side of the ex-dividend day. Their study adjusted the dividends for differences in risk level. They found that it was a possibility to make abnormal profits and even though they examined the possibility for errors in their data, influence of other effects, dividend announcement effect, infrequent trading of securities, and non-normality of securities rates of return, the anomalies in the return on the ex-dividend day could not be explained.

Another study which came out the same year and was made by Grinblatt, Masulis and Titman also discussed the ex-day effects and stated that it should be impossible in an efficient market to earn abnormal profits by trading on the public announcement of a stock dividend or split. Their investigation was based on the period surrounding the actual ex-dividend day at both AMEX and NYSE during the years between 1967-1976, with greater returns noted on the AMEX market. This study found that there do exist abnormal returns connected to the ex-dividend day. The five-day returns surrounding the ex-dividend day from –1 to +3 were 1.95% while the typical five-day returns were as low as 0.19 %. As they made careful examinations of their results they could not explain it by any error or misconception, the percentage of positive returns in the ex-date period was unusually large. They also found in their study that the results reached by Elton and Gruber (1970) do not hold, as the abnormal returns cannot be explained by the investors tax rate.

Both these studies agreed on the fact that there did exist a possibility to earn abnormal profits on the ex-dividend day. This has set the pace for further research and investigation in the area, especially in association with changing tax laws as these are thought to be a reason for offsetting the theory that there are profits to be made in connection with the ex-dividend day and that there exists a market inefficiency at this time. The behavior of stock prices concerning ex-dividend days has, since these analyses, attracted a great deal of further interest and investigations and numerous studies have been made on the subject. Many of the results from various studies have proved to be inconclusive in their findings as to whether or not there does exist a possibility to make arbitrage profits. It has been claimed that there are different issues which have an effect on the outcome such as the different tax systems used in connection with ex-dividend, the transaction costs, the risk involved in the trade, and dividend yields and trading volume on the days in question.

Claesson (1987) investigated the efficiency on the Stockholm Stock Exchange. She looked at, among other things, the ex-day effect. When she studied the ex-day effect she calculated the stock return during 15 days on both sides of the ex-day. The return on the actual ex-day was also calculated where she used the same the same procedure to calculate the return as Lakonishok & Vermaelen (1983). The price fall on the ex-dividend day is divided by the stock price on the day before and the same procedure is done with the dividend. The average was then calculated for all ex-days for both measures and finally the ratio between these two averages was calculated.

Claesson pointed out a disadvantage with the measure used above. Since the closing price was used, the normal return on the ex-day was also included in the price fall. This means that the price drop will be underestimated. Claesson therefore calculated two different measures. One was like the one above and the other was adjusted for the normal return on

the ex-day. The adjusted one was calculated in the way that she looked at the return of the market on the shares that did not go ex-dividend. This return was then used to adjust the stock price on the shares that were going ex-dividend. For instance if a stock price was 100 SEK on the day before the ex-day and the return on the market on the ex-day was 2%. Then the stock price on the day before the ex-day was adjusted to 102 SEK in the calculation.

Claesson's study stretched from January 1978 until May 1985 and showed that dividend yield was on average 4.25%. The price drop was on average 4.18%. The ratio between the percentage price drop and the percentage dividend was then 0.984. This gave a return that was (1-0.984) * 4.25% = 0.07 percentage units greater then the normal daily return. The stock price drop on the ex-day was in other words almost exactly the same as the dividend paid out.

Claesson concluded that transactions that are made only based on the ex-day effect are not profitable, but she also stated that it would be more interesting to study the American market since the dividend is paid out quarterly and the effect is greater according to earlier studies.

As mentioned earlier, when the stock market is in equilibrium, the stock should fall by the same amount as the dividend on the ex-day. Despite this, the stock price fall does not always follow the dividend and there are various theories about the reasons for this. One reason might be the signaling effect that the announcement of a dividend creates, but if this is true, the reaction from an efficient market should come on the announcement day and not on the ex-day (Claesson, 1987). This phenomenon might have bigger impact on the ex-dividend day in Sweden since the ex-day occurs the day after the announcement day. There is therefore a lot of other positive or negative information that is delivered in connection with the shareholders meeting and this has its effect on the stock on the ex-dividend day. One example might be if the company

announces a stock split in the near future which often has a big impact on the stock price.

In other markets, such as in US, it is usually several weeks between the announcement day and the ex-day whereby the consequence from the other information delivered on the announcement day already has had its effect on the stock value.

Sweden is a country where the ex-dividend day effect is especially interesting as many things differ from other markets. The tax system is built up in such a way that there are equal taxes for both dividends and capital gains, which makes the investor indifferent about taking out their profits as either of these two. Some stocks are also cross-listed on the US market and the behavior of these will therefore give a good comparison between the Swedish and US market on how the stocks behave on the ex-dividend day. Since the dividend is only paid out once a year there will also be a bigger amount of dividend distributed. This causes the price drop and difference in the stock to be bigger whereby it is easier to notice if any differences between the dividend and the drop in the stock price are present. This is also more interesting from an investor's point of view since the ex-dividend day ratio shows the percentage profit that can be made from each SEK dividend, which means that you get a higher return from each invested SEK when investing in Sweden since the dividend is only paid out once a year. In US you have to invest four times to get the same return. This also means that the transactions costs would be higher in US than in Sweden.

3. Taxes surrounding dividend

The effect of taxes on the market valuation of dividends has become an increasingly important issue. It has traditionally been argued that investors should demand a higher before-tax premium from dividend than from capital gains if dividends are tax penalized. This premium can be received

if the stock price drop on the ex-dividend day is less than the dividend amount, which represents the central theme in this thesis. Elton and Gruber (1970) were the first to discuss the issue that is regarded as the clientele effect that argues that stockowners will hold a specific portfolio, which is chosen on the basis of their after-tax rates of return (Grammatikos 1989). This would mean that the ex-dividend price drop should change with the firm's dividend yield. These earlier arguments claimed that prices on ex-dividend days are such that the marginal investor is indifferent about the stock before or after the ex-date and that the relative price drops on the ex-days can be used to identify the marginal shareholders tax bracket.

It has before been noted that the ex-dividend behavior of stock prices influences the portfolio decisions of investors. Already in 1955, Campbell and Beranek observed that if the prices of shares fall by the full amount of the dividend, then taxable investors will sell more shares before the stock goes ex-dividend and purchase it back after the ex-dividend day. This suggests that investors had a higher tax on dividends than on capital gains and therefore wants to lock in their profit at the lower tax bracket. This will be shown not to be the case in Sweden where taxes are equal and have also been higher for capital gains during the time period for our research.

3.1 Marginal Stockholder Tax Rates

Elton & Gruber (1970) pointed out that a stockholder that sells a stock before it goes ex-dividend loses the right to the already declared dividend. An investor that plans to sell his shares should, if the market is in equilibrium, get the same result whether he sells the stock on the ex-day or the day before. If he sells the stock on the ex-dividend day he retains the dividend but should expect to sell it at a lower price (because of this dividend retention). In a rational market the fall in price on the ex-dividend day should reflect the value of dividends vis-à-vis capital gains to the marginal stockholders (ibid.). Since dividends and capital gains were taxable at different rates when E&G did their study, the relative tax rate on

these two types of income affect the decision. E&G continues with the assumption that if this formulation of the ex-dividend behavior is correct, then one can infer marginal shareholders tax brackets from observing the ex-dividend behavior of common stocks. Further E&G continued with the assumption that the shareholders wish to maximize their after-tax wealth and derived an expression between the ex-dividend behavior of common stock prices and the marginal tax rates of marginal shareholders.

E&G put:

P_B equal to the stock price on the day preceding the ex-day,
P_A equal to the stock price on the ex-day,
P_C equal to the stock price when the stock was purchased,
t_g equal to the tax rate on capital gain,
t_o equal to the tax rate on dividend and
D equal to the dividend

If a shareholder were to sell his stock in a corporation before it goes ex-dividend his per share wealth would be equal to the price he receives for the stock (P_B) minus the tax he must pay on any capital gain incurred by owning the stock (t_c (P_B-P_c)). If he were to sell on the day that the stock goes ex-dividend his wealth per share would be equal to the dividend (D) times one minus his marginal tax rate on ordinary income (1-t_o) plus the after tax return on the sale of the share (P_A – t_c (P_A-P_C)). For him to be indifferent as to the timing of his sale, the wealth received from either course of action must be the same. This reasoning resulted in:

$$PB - tg(PB - PC) = PA - tg(PA - PC) + (1 - t0)$$

They rearranged it to:

$$\frac{PB - PA}{D} = \frac{1 - t0}{1 - tg}$$

The statistic $(P_B-P_A) / D$ represents the ex-dividend behavior that would cause a stockholder with a particular set of tax-rates t_o and t_c to be indifferent as to the timing of purchases and sales of common stock. For the market to be in equilibrium the price movement on the ex-dividend day must be such as to leave marginal buyers and sellers of the stock indifferent as to whether they buy or sell before or after the stock goes ex-dividend. If not, the buyers and/or the sellers would change their timing of purchasing and/or selling until the stock prices were in equilibrium (ibid.).

Elton & Gruber recognized that both sides of the equation above should have been adjusted for transaction costs. They argued that 1 per cent might be a reasonable estimate of the transaction cost and therefore their statistics could be 1 per cent off.

Elton & Gruber studied the clientele effect and found that the price change relative to the dividend per share positively correlates with the dividend yield, which could be expected if investors in high tax brackets hold low dividend yield stocks (and vice versa). Their sample data consisted of all stocks listed on the New York Stock Exchange that paid dividend during the period April 1, 1966 to March 31, 1967 and were traded on both the ex-dividend day and the prior day. They defined P_B as the closing price on the day before a stock went ex-dividend, P_A was measured by the closing price on the ex-dividend day. They found the ratio $(P_B - P_A)/D$ to be equal to 0.7767 when they used the raw data for the entire sample. Elton & Gruber recognized a potential bias that can occur by using the closing prices on the ex-dividend. To adjust for this potential bias they estimated the P_x by subtracting the average market movement from the P_A. The average market movement was calculated by looking at the return on the ex-day on all shares that did not pay out dividend on that day and then calculated an average on these returns. They found the adjusted ratio $((P_B-P_X)/D)$ to be 0.7868. They also calculated the average marginal tax bracket for

shareholders on the New York Stock Exchange to be 36.4 percent, which they found to be a reasonable result.

3.2 Short Term Traders Hypothesis

Kalay (1982) disagreed with Elton Gruber (1970) that the marginal investor is a stockholder that has decided to make a transaction based on reasons not associated with the ex-dividend day, so called long-term investors. Kalay (1982) and Miller & Scholes (1982) brought forward another argument know as the "short term traders" hypothesis. This argues that if the drop in the stock price on the ex-dividend day is different from the actual dividend amount, short-term traders who face no different taxes on dividends and capital gains could make arbitrage profits. It has also been argued that transaction costs, if large enough, may inhibit this arbitrage process. In today's society there are several ways to get around the expensive transaction cost with the Internet trading and other legal escape holes. Especially short-term traders have a great opportunity to minimize their transaction costs. Kalay then meant that the marginal investor is probably no longer representative of the company's marginal stockowners, which Elton & Gruber assumed in their study. This argument led to the dividend capture hypothesis, proposed by Kalay (1982) and formulated by Karpoff and Walking (1990). The dividend capture hypothesis implies that the observed ex-day effect for the j^{th} stock, can reflect either long-term investors' marginal tax rates, as in Elton & Gruber (1970), or dividend capture traders' transaction costs also called the short-term trading hypothesis. A study made by Lakonishok and Vermaelen (1986) investigated trading surrounding ex-dividend days and found that the short term traders hypothesis held. They found that for cash dividends the trading volume increased significantly around the ex-dividend day. The results were found to be consistent with the hypothesis that short-term traders have an impact on ex-dividend price behavior, at least for taxable distributions (Lakonishok and Vermaelen 1986).

Kalay re-examined the ex-dividend day behavior of stock prices that Elton & Gruber (1970) made. He used the sample data of 2,540 cash dividends paid between April 1, 1966 and March 31, 1967. Kalay argued that Elton & Gruber and others used the wrong stock prices when they estimate the ex-dividend day behavior. He pointed out that the evidence concluded by Elton & Gruber may be subject to potential bias from the use of closing prices of both the ex-dividend day and the day prior to it in calculating the tax rates implied from $(P_B\text{-}P_A) / D_{,o}$ account of the normal daily price change in that price.

To illustrate he put:

P_B = closing price on the last cum-dividend day
P_A = closing price on the ex-dividend day
P_X = the first ex-dividend price

To compare the price drop to the dividend per share, $(P_B\text{-}P_X)$ should be estimated. Because by using the closing prices on both days, the ex-dividend price drop is biased downward.

Formally:

$$\frac{PB - PA}{D} = \frac{PB - PX - rPB}{D}$$

Where r = the expected daily rate of return of the stock investigated. The downward bias is rP_B/D. This means that for an average quarterly dividend yield of 0,01 and a daily return of 0,0003, the downward bias is 0.03. Kalay meant that the correction made by Elton & Gruber can remove or at least reduce this bias in estimating the mean $(P_B - P_X)/D$. He however, recognized that a bias still can exist in the estimation of the correlation between $(P_B - P_X)/D$ and D/P since the downward bias in estimating $(P_B - P_X)/D$ using unadjusted closing prices is larger for stocks with higher

expected rates of return and lower dividend yields. So if the expected daily rate of return is uncorrelated with the dividend yield, then Kalay meant that the correction made by Elton & Gruber is correct. Kalay points out that "recent" studies have shown that risk, β, is negatively correlated with the dividend yield. Hence, the expected daily price appreciation is bigger for stocks with low dividend yield. This means that the downward bias in estimating $(P_B - P_X)/D$ is stronger for stocks with small dividend yields because D/P is smaller and r is larger than those associated with high dividend yield. Therefore, Kalay meant that a more extensive correction for the "normal" price movement is required.

Kalay adjusted the data in two ways to avoid the potential bias caused by the "normal" price movement. First, the stochastic process generating returns was assumed to be stationary. Based on the martingale model, he estimated an unbiased security expected daily return was obtained from the time series of its realized returns. The time period he used to obtain this estimate was July 1962 to the end of 1965. The ex-dividend price of security j was then estimated as the discounted closing price on the ex-dividend day. The second method of correction he used was based on the "market model".

The time series regression was estimated for each firm in the sample for the period July 1962 to the end of 1965. Kalay then calculated the mean by using three estimates for P_x: the unadjusted closing price on the ex-dividend day, which was equal to 0.734; the closing price on the ex-dividend day discounted by the average daily return which was equal to 0.881; and the closing price on the ex-dividend day discounted at the conditional expected return obtained from the market model, equal to 0.821.

The transactions costs have earlier been used as an argument to discard the ex-dividend day effect but as new and increased competition has entered the market, this cost has significantly decreased and the nominal cost of

trading has fallen significantly, especially for large transactions where it is almost invisible, but also for smaller trades. The transactions costs will therefore not be considered in this thesis.

3.3 The Swedish Tax System

The possible money to be made on the ex-dividend effect depends to a large degree on the percentage of taxes that has to be paid for dividends as well as capital gains and if there is a difference between these two taxes. This chapter will discuss the Swedish tax laws and see what differences as well as similarities exist between the different taxes and also if there are any differences between the sorts of legal entities that are receiving the dividend.

Civil law discusses the Swedish stock company law (SCL) chapter 12, where the amount of the companies' dividend that is allowed to be given out to stockowners is regulated. In this 12th chapter it is stated that payment to the stockowners of the company's money only can be done in regulation with SCL's chapter 12 regarding profit allocation and distribution concerned with reduction of the stock capital or the reserve fund (Skattehuset I Göteborg AB, 1998). A company can only give out dividend from the capital that is part of the balanced year profit, the year's profit, and free funds. The board of directors makes the decision about dividend payout.

The Swedish tax system has changed its taxes on dividends as well as capital gains quite vividly during the past few years (See Table 1). This has caused a interesting shift in the effect taxes have had on the ex-dividend returns if there do exist any abnormal profits to be made on the Swedish market. According to Skattebetalarna (1999), there have been tremendous shifts in the tax on dividends, corporate tax and taxes on capital gains in both Swedish stocks and companies as well as foreign.

	1983	1991	1994	1995	1998
Corporate Tax	58	30	28	28	28
Dividends (Swedish stocks)	84	30	0	30	30
Dividends (Foreign stocks)	84	30	30	30	30
Capital Gains (Swedish stocks)	84-34	30	12.5	30	30
Capital Gains (Foreign stocks)	84-34	30	25	30	30

Table 1: Swedish Tax Rates between 1983-1998

These different taxes have an especially big impact on Sweden as a country as well as the interest and concern at times such as dividend pay-outs since half of the population is a stockowner of some kind and has a stake in the results (Ekonomi Fokus 1997).

Aktiespararnas Aktieskatteguide (1997) writes that it was in the beginning of 1991 that the Swedish government imposed a significant new tax reform, which was announced as the "tax reform of the century". This reform brought with it several big changes and it especially had an effect on the taxes on stocks and their dividends.

All capital incomes were brought together to one type of income named as capital income. By doing this the taxation of capital gains and dividends were set to be equal. This would increase the possibilities to cancel out different incomes and expenses against each other. The incomes from capital were to be taxed separately from the incomes made from employment and this made these two taxes become independent of each other.

At first the tax on capital was set at 30%. Then the government at that time lowered the tax on stock profits, at first to 25% and then to 12.5%. The tax on dividend was lowered from a rate of 30% to a rate of 0% in 1994. These extremely low taxes were set in 1994 but were quickly changed to their current level of 30% in January 1995, as a new party came to power. This is still the case today in regards to taxes.

A comparison study was made between the countries in Europe where there exist several different systems for taxing stocks. But it was found that no matter how you look at paid out dividend, possession or profits at sale of stocks, Sweden belongs to those countries that has the highest taxes on private investors and actually places itself way above the average (Ibid.) This high taxation makes the capital allocation more difficult and therefore lowers growth and employment. The tax in connection with dividends is a so-called double taxation as both the companies and the recipient of the dividends pay tax on the amount that they receive. First the companies have to pay a corporate tax of 28% on the profit they make and when they later pay dividend the receiver has to pay a tax of 30%. If you compare this to other countries in the EU there are 10 members who do not even have the double taxation. This has caused several companies to move their operations abroad. Sweden and Finland are also the only countries that count the whole difference between the price of the stock when you first bought it and the price you get when you sell the stock as taxable no matter how long you have owned the stock. This way you also pay a tax on the increase in the value due to inflation, which is a value that never benefited or even was seen by the investor.

However, the current Swedish tax system has a equal tax of 30% on both the dividends received and the capital gains on a stock. The capital income is therefore taxed separately from earned income at a flat rate of 30% while the earned income is a progressive tax. The capital tax base is calculated as a sum of received interest payments, dividends and capital gains during the year minus the interest expenditures. If the net values are negative, an amount corresponding to 30% of the net loss is deductible as tax credit against the national and local tax on earned income as well as taxes on real estate and wealth. If the tax credit exceed these taxes, you cannot carry forward any of the remainder to use as a relief against future taxes (Skattebetalarna 1999).

As mentioned before the corporate income and profits are taxed according to a double taxation policy where the corporate income tax first is levied and after that the receivers of the dividend are taxed according to capital income tax on the dividend that they receive. To be able to avoid being triple taxed or even higher than that, dividends that are received by corporations owning at least 25 percent of the shares in other corporations are tax-exempt (Ibid.).

According to Skattebetalarna (1999), the dividends paid out as well as capital gains are also taxed differently depending on what kind of company is paying the dividend. Dividends received from closely held firms are exposed to special rules concerning dividends. In principle, they are taxed as income from capital (at 30%) up to a level where the dividend amounts to the risk-free rate of interest plus an additional five percentage points of the capital invested in the firm by the owner. Any dividend received above this level is then taxed as income from employment that is, as mention earlier, progressive. There are no social security fees that are levied in this case. Special rules also apply for the sale of securities in closely held firms. Half of the gain is taxed at a progressive tax rate as income from employment and the other half as income from capital at 30%. There is a maximum amount of 100 base points (SEK 3,640,000), which is taxed as income from employment and no indication of acquisition value is permitted.

The other firms, which pay out dividend in Sweden, are taxed on a worldwide basis as basic income from capital. Postponement of taxation is not possible.

There does exist a relief from the double taxation to owners of non-quoted corporations. This tax relaxation is calculated as 0.65 percent of the current borrowing rate of the capital invested in the firm by the owner.

The year of 1994 has been included in our investigation and represents a year when the difference in the two taxes was quite large and even opposite of what is normal when the tax on dividends is higher than capital gains. We will perform further investigations on this to see if there are any differences in the results for this year compared to when the taxes are equal. This will give us an opportunity to examine the effects of ex-dividend day behavior during two different tax rates and to be able to see if any differences exist between the two. For our study the years since 1995 have, as discussed before, exhibited the same taxes on both capital gains and dividends. According to De Ridder and Sörensson (1995) this means that the equation for ex-dividend day returns could be re-stated as:

$$\frac{Pb - Pa}{D} = 1$$

This would therefore mean that if there were no transactions costs involved in the transaction, the difference between the price at the day before ex-dividend and at the ex-dividend day would be equal to the amount of the dividend. As a result, if there do not exist any arbitrage opportunities and hence the market is in equilibrium, this ratio should be equal to unity (Ibid.).

Even at equal taxes, past studies have found, at least in US where there are dividend payouts four times a year and therefore four ex-dividend days, that there do exist possibilities to make above normal profits or so called arbitrage profits when talking about the ex-dividend day phenomena.

3.4 Tax reforms impact on ex-dividend day stock price behavior.

Depending on what tax levels are charged on dividends, people should behave in different ways on the ex-dividend day to get the best return on their investment. If taxes on dividends are higher than they are on capital gains people's reactions should be to sell their stock before the ex-dividend

day to lock in a capital gain and buying it back on the ex-dividend day. This way they would pay the lower tax. This also goes for the difference where taxes are higher on capital gains than on dividends. Then investors should keep their stocks and receive the dividends instead of being taxed for capital gains. According to Elton & Gruber's investigation about the equilibrium asset-pricing hypothesis, higher tax on dividend relative to capital gains should lead to a smaller drop in stock prices on the ex-dividend day and a equal tax would give the same price drop as the amount of dividend. Many studies have been performed on how the ex-dividend stock price behavior react to changes in tax laws. Below are a few examples on how the prices have reacted on three different markets, the Canadian, the American, and the Swedish stock market.

Lakonishok & Vermaelen (1983) examined the ex-dividend behavior of Canadian companies in the Toronto Stock Exchange around a major reform in the taxation of dividends relative to capital gains. Their sample data consisted of 555 observations in 1971 and 671 observations in 1972.

The Canadian tax reform increased the value of a dollar of taxable dividends relative to a dollar of capital gains for all taxable investors. Prior to 1971, Canadian investors who received income from Canadian companies in the form of dividends were granted a dividend tax credit equal to 20 percent of the dividend. In addition, shareholders received a provincial tax credit equal to 28 percent of the net federal tax paid. Capital gains were tax exempt however, so that in spite of the tax credit, capital gains would have been preferred to dividends by all shareholders with a marginal federal tax rate above 20 percent. Using the 1971 tax rate schedule, this would apply to anyone earning more then $4,000 per year.

As a result of the 1971 tax reform, from January 1972 dividends were to be grossed up by a third and a tax credit equal to 20 percent taken for federal tax purpose. In addition, a capital gains tax was introduced. Marginal federal tax rates were reduced but the provincial tax credit was abolished;

instead a provincial tax equal to 30.5% of the net federal tax had to be paid. This reform made every ordinary investor with a marginal federal tax rate below 32 percent prefer taxable dividends to taxable capital gains. In 1972 this would apply to persons with taxable income below $14,000.

It was found in their study that in 7 out of 8 cases the average relative price drop was smaller in 1972 than in 1971. In 1971 the ratio $\Delta P/D$ was equal to 0.264 and in 1972 the ratio was 0.326.

Lakonishok & Vermaelen came to 3 conclusions: First, ex-dividend day stock prices fell by a smaller amount in Canada than in the U.S. Second, the relative price change was larger in 1971 than in 1972. Third, a positive relation between dividend yield and relative price changes exists, but it is less pronounced than reported in studies that employ U.S data.

There have been several studies made on the 1986 U.S tax reform's (TRA86) impact on the ex-dividend day stock price behavior. The tax reform eliminated the preferential tax treatment of long-term capital gains, which was adopted in 1921. Dividend income and capital gains were now treated equally for tax purposes (reduced in 1987 and completely eliminated in 1988). Michaely (1989) showed that this tax change had no effect on the ex-dividend stock price behavior, which he concluded to be consistent with the hypothesis that long-term individual investors have no significant effect on the ex-day stock prices during this time period. Michaely´s sample data consisted of all firms listed on the NYSE, which paid dividend during the 1986-1989 period. He adjusted the ex-day closing price by the expected daily return. He also made a second adjustment because of the heteroskedasticity in the premium's variance, which increases the ex-day price change of small dividends relative to large dividends. He pointed out two sources of heteroskedasticity. First, each security has its own conditional variance. He estimated these variances from the time series regression and adjusted accordingly. Second is the dividend yield itself, in the way that the heteroskedasticity is proportional

to the ratio of the dividend yield to the disturbance variance. Michaely found the mean, after adjustments, to be distributed according to Table 2.

Year	Mean
1986	1.054
1987	1.028
1988	0.998
1989	1.009

Table 2: Michaely's mean on the NYSE 1986-1989

Koski (1996) examined the ex-dividend observations for ordinary cash dividends during 1983 to 1988, using marginal conditions that explicitly model trading at bid and ask quotations. Her statistics suggested that marginal price declines increase relative to the dividend amount during the period studied. Han (1994) found that stocks listed on the NYSE were not affected by the TRA86. His results however, indicated that the reform had a significant effect on the ex-date returns for NASDAQ stocks. He found that the ex-date returns on NASDAQ stocks significantly decreased after the reform. Han (1994) explained that the reason for these different results from the two exchanges was because the ex-date returns of NASDAQ were dominated by the tax-premium whereas those of NYSE stocks were dominated by short-term trading.

Robin (1991) tested the hypothesis that the tax reform of 1986 should decline the ex-day abnormal return, consistent with the decline in the tax premium. He found that the ex-day abnormal returns declined from 0.152% during 1984-1986 to 0.038% during 1987-1988.

Lamdin & Hiemstra (1993) found like Koski (1996) and Robin (1991) but opposite to Han (1994) and Michaely (1989) that the TRA86 had an impact on the ex-day stock price behavior on the NYSE. Their sample data was collected from the years 1982 to 1991 and they concluded that share price fell, on average, by a larger proportion of the dividend after TRA86 than before. Their mean was distributed according to Table 3.

Year	Mean
1982	0.872
1983	0.880
1984	0.880
1985	0.879
1986	0.921
1987	0.986
1988	0.884
1989	0.872
1990	0.770
1991	0.980

Table 3: Lamdin & Hiemstra's Mean on the NYSE, 1982-1991

The reason for different studies coming to different conclusions on the impact of TRA86 may depend on which method they have used to adjust the closing price on the ex-day or maybe their sample data have not been exactly the same.

De Ridder & Sörensson (1995) studied the ex-dividend day behavior of stock prices before and after the Swedish tax reform that took place in 1991. The tax reform included a reduction of the tax on dividends and made the taxation of dividends and capital gains equal. Before the reform, the tax rate on dividends was between 50 and 85 percent depending on the investors marginal tax rate. After the reform, the tax rate was reduced to 30 percent. Their study was based on a sample of 1,852 ex-dividend dates for firms listed on the Stockholm Stock Exchange during the period 1980-1993. They showed that the Tax reform had no effect on the ex-dividend stock price behavior. However, they found that during the period between 1980-1984 the price determination was dominated by corporate traders since the price drop was close to the dividend amount. During the period between 1984-1993 they found the price drop to be much lower than the dividend, which indicated that long-term investors dominated the price determination.

As we can see from the empirical studies summarized above, there is inconclusive evidence for whether or not a change in the tax system influences the ex-dividend day stock price behavior. Maybe this shows that making laws governing the market might not always prove to give the effects that they were supposed to.

4. Method

This chapter will discuss the methods that have been used when we have collected our data and how our study has been performed.

4.1 Data Collection

Our sample data consists of all Swedish stocks listed on the Stockholm stock exchange that paid out cash dividends during the years 1994-1998. The choice of companies and the time period for the thesis were based on several different criteria.

Earlier research, which covers the area of investigation on the Swedish market, has been made from 1978 up to the year 1985 by Claesson (1987), and between 1980 to 1993 by De Ridder and Sörensson (1995), and therefore we chose to continue where their research ended and chose to start in 1994. Their base for the study consisted of the 50 biggest companies for the former and the stocks listed on the A-market and the OTC-market for the latter. We chose to cover a five-year period in order to get a large enough number of ex-dividend day occurrences to be able to perform accurate and reliable research on a big enough collection of companies. The companies chosen were the ones listed on the Stockholm Stock Exchange on the A-market, O-market and the OTC-market. The total number of collected ex-dividend day quotes used in the analysis was 837, which were divided according to table 4. The collection was primarily based on showing a correct and reliable value for our results, but also to be

able to compare the different markets with each other to see if any discrepancies exist between them.

	A-market	O-market	OTC-market	Total
1994	84	17	26	127
1995	102	31	39	172
1996	112	19	42	173
1997	111	23	38	172
1998	96	49	48	193
Total	505	139	193	837

Table 4: Frequency distribution of ex-dividend dates.

During this time-period there were several companies that did not pay out dividends and therefore they have been excluded from this study. The number of companies each year have therefore been different because of this and also because there are companies which have left and entered the markets. We have also discarded the foreign companies listed on the Stockholm Stock Exchange, except for Nokia, which is considered to be a Swedish related stock and Autoliv Inc. and Pharmacia &Upjohn Inc. that have been Swedish before and therefore these were included in the collected data. The SBI-market has not been included as it consists of small companies with very little trading and almost no dividend being paid out. These were therefore considered not to be statistically reliable.

The stock quotes we have chosen for each company are the closing prices on the day before the ex-dividend day and the closing prices on the ex-dividend day. These stock quotes were chosen because of the availability of data and the time consuming matter of collecting the material needed. The closing prices were also chosen due to the lack of past information about how the stock prices have developed during the ex-dividend day. As Kalay (1982) pointed out, it might give a better result if the first ex-dividend price was included in the study but as we have not been able to find this, the closing price was used instead. The closing price is therefore influenced not

only by the fact of the ex-dividend day and the reaction in the stock price due to dividend, but also by the stocks "normal" daily returns.

Most of the stock prices were collected on the database FT Prices. FT Prices is a database, which contains the economic tables that are available in the Financial Times. It is used to collect the price development for stock in single companies in Europe from 1987 and forward, to collect the development of the general index and branch indices in many countries, and also to collect materials about changes in currencies. This database is updated every month. However, some stock prices were missing on FT prices so we had to complement these stock quotes by looking at old copies of Dagens Industri. The data about companies that were missing in FT Prices were the ones who have foreign ownership as well as those companies who have merged and after that changed the company name and also a few other companies that were missing for unknown reasons (Appendix 1). The Dagens Industri magazines that contained historical data were found on microfilm in the KTB library in Gothenburg and by looking up the specific dates when the ex-dividend day occurred, the stock quotes needed were found. The figures in Dagens Industri were also checked with the figures about the data on stock prices we attained from FT Prices in order to see that the source was reliable. This proved to be perfectly accurate where the same quotes were showed in both FT Prices and Dagens Industri.

All data concerning ex-dividend dates and dividend amounts have been collected directly from Stockholm's Stock Exchange.

4.2 Validity and Reliability

The validity and reliability of this research depends both on which material is collected and how it is treated once received. Validity is concerned with whether or not the developed framework is a relevant representation of reality and if it measures what it is supposed to measure. The reliability of

the study depends on how reliable the measurement, literature and all other information collected are.

The data that has been collected in this research consists of information that has already been published and has been gathered through secondary sources. The actual data used for the empirical study has been collected through sources, which are believed to exhibit a high degree of reliability. These sources are composed of material collected from the Stockholm Stock Exchange, which consists of the ex-dividend dates and the amount of dividend. The stock prices for both the cum-dividend day and the ex-dividend day have been collected through FT-Prices and Dagens Industri.

The facts collected from these sources are by themselves also very reliable and valid as they are a direct representation of reality with figures such as the stocks closing prices, dividend amount and ex-dividend day. The models used in our study are the standard models used when calculating the ex-dividend day effect. This will give the study good validity and it will measure what it is supposed to measure.

The data and material used in the research are based on facts and original data. If another researcher investigated the same phenomena as we investigated and started from the same basis, he or she would get the same results and answers from them. Therefore the reliability of our thesis is high.

4.3 Framework of the Research

This study will look at the difference between the stock price on the day before the ex-dividend day as well as the stock price on the ex-dividend day and compare the difference between these to the amount of dividend being paid out. Our sample data consists of the Swedish companies listed on the Stockholm Stock Exchange that paid out dividend during the time period 1994 – 1998. This amounts to 837 observations. By analysing this

and performing various tests on the data, it is possible to see if there is a relationship between these values that will show if there exists a possibility to make arbitrage profits in connection with the ex-dividend day or not.

This research will present a measure of the ex-dividend day effect, which is based on Elton & Gruber's (1970) method that calculates the ratio between the price drop in the stock and the dividend amount paid out for each share. After this, an average is calculated for all stocks. This number will give us the average price drop per SEK paid out in dividend. This is the most commonly used method when calculating if there exist arbitrage opportunities on the ex-dividend day since it shows how much the price drop and dividend differs.

Lakonishok & Vermaelen (1986) and Claesson (1987) chose a different approach to calculate the price effect on the ex-dividend day. In their calculations the price fall on the ex-dividend day as well as the dividend is divided by the stock price on the day before the ex-dividend day. Then an average on each of these measures is found whereby a ratio between these two numbers is established. Claesson claimed that this was a better measure because it represents an equally weighted portfolio of all stocks that has had an ex-dividend day during the period measured. In the measure used by Elton & Gruber (1970), shares with low dividend are given a higher weight than high dividend shares.

We are concentrating on the arbitrage possibilities on the ex-dividend day and therefore we find that the Elton & Gruber method is more useful for us than Lakonishok & Vermaelen's method. Both measures have a disadvantage because of the fact that we are using the closing prices and therefore have to adjust for the "normal" returns that are received. This will be described later in a separate section of this chapter.

The formula that will be used to calculate the ex-dividend day effect will be the following:

$$(Pcum - Pex) / D = E$$

Where:

Pcum = Share price on the day before the stock goes ex-dividend
Pex = Share price on the ex-dividend day
D = The dividend amount
E = Ex-dividend ratio

We have defined the top and bottom 5% of our observations as outliners and they have therefore been excluded from the study. These figures show an indication that other factors play a role in the price adjustment on the ex-dividend day. One important reason is the fact that the shareholders' meeting most often is held on the day preceding the ex-dividend day and other information about the company is given to its shareholders, whereby the price reacts to this. For example, there have been several observed dates where the stock price has increased dramatically and this has been due to an announcement of a stock split. By excluding the top and bottom 5 %, we believe that the results will give a better answer to the price correction that occurs only on behalf of the fact that it is the ex-dividend day.

Pharmacia & Upjohn Inc. and Autoliv Inc. dividends payout were listed in dollar amounts and therefore these were corrected by finding the correct currency for the dividend on the ex-dividend date between SKR and US$. These were found on the Swedish Postal Office Homepage.

The next step in the analysis will be to compare the different markets that are included in the Stockholm Stock Exchange and to see if there exist any differences in the possibilities to make money between them. The A-market, O-market and the OTC-market will be tested using the same

procedures as discussed above. There will also follow a comparison between the Swedish stocks which have been listed on the US stock market and stocks not listed in US to see if there exists any difference in the price correction and efficiency between these (Appendix 2).

When we derived the results from these underlying figures we calculated each year by themselves and compared it to the other years included in this study. This is especially interesting for the year 1994 when the taxes on dividends and capital gains were taxed at a very low rate compared to 1995-1998 where the taxes were set equally. There will also be a comparison between them depending on whether the dividend yield has been high or low. This will show if there does exist a clientele effect and if this attracts a special sort of investor, as Elton & Gruber (1970) concluded in their paper.

4.4 Adjustments for Normal Returns

In order to adjust the data on stock prices for the normal returns on the ex-dividend day we have used a market-adjusted method. This means that we have adjusted the cum-dividend price with the change in the market return on the ex-dividend day. This market return was obtained from Affärsvärldens General Index. The adjusted cum-dividend price was then calculated by using the following formula:

$$Px = Pcum * (1 + (I / 100))$$

Where:

Px = Adjusted cum-dividend price
Pcum = Unadjusted cum-dividend price
I = Market index return in percentage

This will give us new formulas to calculate our adjusted ratios of the ex-dividend day effect. These are the following:

$$(Px - Pex)/D = Ex$$

Where:

Ex = Adjusted ex-dividend ratio

Another method that could be used for correcting for normal returns is a market model adjusted method where the market return also is adjusted with the companies' own beta. This would give a risk adjusted market return. The beta values were not calculated since it would mean estimating 837 different beta values. Furthermore, Brown and Warner (1985) show that the market adjustment and market model adjustment provide similar results. Because of this and the lack of time, the adjustment model used in this thesis will be a market-adjusted method.

4.5 Tests of Results

In order to test the significance level of our results we first have to set up a hypothesis, which will be either rejected or accepted.

4.5.1 Hypothesis

A null hypothesis (H_0) is a statement about one or more parameters. This statement is assumed to be true until you have enough statistical proof to reject it. The alternative hypothesis (H_1) stands for all statements, which are not covered by Ho. Together the null hypothesis and the alternative hypothesis cover all values that the actual parameter can take.

In order to be able confirm or discard a hypothesis you need a decision rule that explains under which circumstances the null hypothesis can be

rejected. If the null hypothesis is rejected the alternative hypothesis is automatically accepted. In connection with rejection of the null hypothesis, two possible mistakes are usually considered. First the hypothesis might be rejected even if it is true and secondly it might not be rejected even though it is wrong (A.D. Aczel 1993). It is very important not to reject something that is true and in order to avoid this a significance level usually is set up. This significance level can be set at a very low level such as 0.01, 0.05 or 0.10 in order to avoid this mistake. The probability (α) can be stated as follows:

α = P (Reject H_0 | Accept H_0)

The value you put on α develops the decision rule you use when rejecting the null hypothesis. The significance level is represented by α, which also is the same as the probability to make the first mistake. The decision rule used when performing a statistical hypothesis test can for example consist of comparing the calculated t-value with the value, which defines the area of rejection and acceptance. The null hypothesis is rejected with significance α if the t-value is a value inside the rejection area. The rejection area is set up in such a way that the investigated parameter only has probability α to end up inside the rejection area if the null hypothesis is true.

The first hypothesis that should be tested in this thesis is whether or not the drop in the stock price on the ex-dividend day is the same as the dividend that will be paid.

H_0: There are no arbitrage possibilities on the ex-dividend day, hence the price fall in the stock is equal to the dividend being paid out.
H_1: There are arbitrage possibilities at the ex-dividend day and therefore the fall in the stock price is less than the amount of dividend being paid out.

If the first hypothesis is rejected a second hypothesis will test to see if the difference can be explained by taxes.

H_0: *The difference can be explained by the taxes.*
H_1: *The difference can not be explained by taxes.*

The third hypothesis will be to test and see if the ex-dividend effect is the same across the different markets.

H_0: *The ex-dividend effect is the same across the different markets.*
H_1: *The ex-dividend effect is not the same across the different markets.*

4.5.2 Significance Tests

The tests used to test the null hypothesis are the t-test, the Wilcoxon significance test and the Wilcoxon ranksum (Mann-Whitney). The normal t-test will be used to test if the ex-dividend day effect is different from 100% and arbitrage is possible. A Wilcoxon significance test will be used to test if the differences in the medians differ from zero and this test is performed when the distribution looks like it is skewed which means that the mean is not equal to the median. The difference between the different markets within Stockholm's Stock Exchange as well as between the stocks listed in US and the ones only listed in Sweden will also be tested with a t-test and the medians with a Wilcoxon ranksum (Mann-Whitney) test.

The concept of statistical significance is based on the assumption that events, which occur rarely by chance, are "significant". Traditionally, events that occurs less than 5% are said to be statistically significant. Individual scores outside the –1.96 and + 1.96 boundaries on the normal distribution curve occur less than 5% of the time (see figure 1).

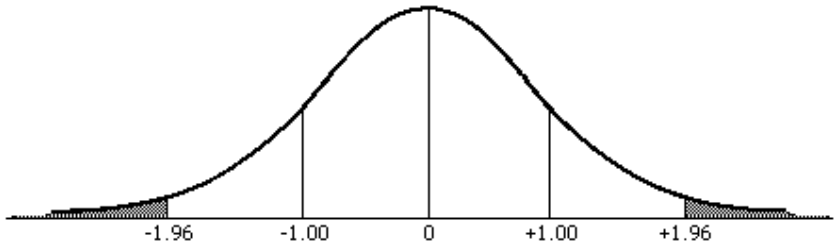

Figure 1: Normal distribution curve.

The t-test is used to assess whether two sample means differ for a given level of statistical significance and it assumes that they are statistically independent. It is defined as the difference between two-sample means dividend by the standard error of the difference. The t-test is most often used to compare the results for an experimental and a control group in an experiment with only two treatments.

The formulas used to perform the t-test for the difference between the price drop in each market and the t-test formula used to test the difference between the different markets are the following:

$$t1 = \left(\frac{Mean}{\left(Std \Big/ \left(\sqrt{n} \right) \right)} \right) \quad \text{and} \quad t2 = \left(\frac{\left(Mean1 - Mean2 \right)}{\left(Std \Big/ \sqrt{n} \right)} \right)$$

Where:

t_1 = t-value for difference within each market
t_2 = t-value for difference between markets
Mean = The difference between the price drop and the dividend
Std = The Standard Deviation of the population
n = Number of observations

A Wilcoxon significance test can be employed when a random sample of matched pairs of observations is available. This test provides a method for

incorporating the relative sizes of the differences between these matched pairs and is used to test the null hypothesis that the population median of the paired difference of the two samples is 0. This test sorts the absolute values of the differences from, smallest to largest, assigning ranks to the absolute values and then finding the sum of the ranks of the positive differences. If the null hypothesis is true, the sum of the ranks of the positive differences should be about the same as the sum of the ranks of the negative differences (Rees 1990). The null hypothesis is rejected if the Wilcoxon test statistic T is less than or equal to the value found in the Wilcoxon table.

The Wilcoxon SignRank test formula is the following:

$$Z = \frac{(T - E(T))}{Std(T)}$$

In which:

$$E(T) = \left(\frac{(n) \times (n-1)}{4} \right) \text{ and } Std(T) = \sqrt{\left(\frac{((n) \times (n+1) \times ((2 \times n)+1))}{24} \right)}$$

Where:

Z = The distribution of the Random variable
T = The Wilcoxon statistic
E (T) = Expected value of the distribution
Std (T) = The standard deviation of the distribution

When you have 2 independent groups, a Wilcoxon rank-sum or Mann-Whitney test is used to compare the medians of the two groups rather than the means of two groups if the t-test, which tests the means, is not appropriate (Watson et. al. 1990). If the two populations have the same distribution then the sum of ranks in the first sample and those in the

second sample should be close to the same value. The Mann-Whitney (Wilcoxon Rank Sum) test will be used to test if there is a difference in the medians between the different markets on the Stockholm Stock Exchange and also between the stocks which are cross-listed in US and the stock that are not cross-listed. This test is performed by using the following formula:

$$t = \frac{(U - E(U))}{Std(U)}$$

In which:

$$U = ((nus) \times (nsweden)) + \left(\frac{(nus \times (nus + 1))}{2} \right) - R \ , \ E(U) = \left(\frac{(nus) \times (nsweden)}{2} \right)$$

and $$Std(U) = \sqrt{\frac{((nus) \times (nsweden) \times (nus + nsweden + 1))}{12}}$$

Where:

nus= Number of observations in US
nsweden= Number of Observations in Sweden
R = The sum of ranks of the observations from the first distribution
U = Random variable
E(U) = Expected value of the random variable
Std (U) = Standard deviation of the random variable

The tests for significance of our results are performed in the statistical computer software SPSS (Statistical Programs Service Solutions).

When performing our significance tests, we will use three different significance levels to test our results. H_0 is rejected with a 90%, 95% and a 99% significance level when the absolute value is larger than 1.64, 1.96 and 2.58 respectively. These are denoted by * (90%), ** (95%) and *** (99%).

5. Empirical Results

This chapter will consist of our tests and analysis of the data collected about stocks on the Stockholm Stock Exchange between the years 1994 - 1998. The data is examined and tested to see if there does exist a possibility to make arbitrage profits for stocks in connection with the ex-dividend day.

5.1 The Stockholm Stock Exchange

This section will examine the data on the companies listed on the Stockholm Stock Exchange as a whole and analyse the average price adjustments.

The first test to see if there exist arbitrage opportunities was done on the Stockholm Stock Exchange with prices, which not were adjusted for the normal returns (See table 5). The average price adjustments during the period examined amounted to 0.619. The median value was 0.698. The adjusted figures shows a higher ratio where the model gives an average of 0.623 and the median is 0.715 (See table 6). These values are statistically significantly less than unity at the 1 % level.

Year	Average	Median	T-value	Wilcoxon
1994	0.827	0.857	0.791	0.880
1995	0.400	0.500	6.071***	6.706***
1996	0.572	0.700	4.131***	4.511***
1997	0.796	0.800	2.185**	2.351**
1998	0.513	0.750	3.538***	3.275***
1994-1998	0.619	0.698	7.155***	7.891***

Table 5: Unadjusted ex-dividend ratio for the Stockholm Stock Exchange

Year	Average	Median	T-value	Wilcoxon
1994	0.743	0.818	1.810*	1.119
1995	0.460	0.503	6.134***	6.438***
1996	0.587	0.724	4.484***	4.789***
1997	0.901	0.862	1.139	1.398
1998	0.432	0.688	4.986***	4.197***
1994-1998	0.623	0.715	7.855***	8.061***

Table 6: Adjusted ex-dividend ratio for the Stockholm Stock Exchange.

These results show that there does exist a possibility to make arbitrage profits in connection with the ex-dividend day for the time period studied. The ratio has varied between 0.432 in 1998 up to 0.901 in 1997. The average price corrections were only around 60 percent of the amount of the dividend for the whole period. When looking deeper into the years included in the study one will notice that there was only a very small price correction for the years 1995, 1996 and 1998 and a much larger correction in 1994 and 1997. Even though the results have varied and occasionally been high, all the years in our investigation show that there does exist an ex-dividend day effect. It is especially interesting to see that the price correction in 1994, when the tax on dividend was zero and the capital gains tax was 12.5%, is very high. When comparing this to 1995 when the taxes on both dividend and capital gains were changed to 30%, one can see that there is a large difference between these where the price correction was about half this year compared to 1994. This shows that the low tax on dividends compared to capital gains in 1994 attracted short-term traders.

The tax on dividend affects investors behaviour whether the tax on capital gains is the same or not. If the investor has capital losses one year he can choose to realise his profitable shares in order to balance his capital gains against his losses. In the case of dividends, the investors can not decide when to take out their profits as it is the companies that decide when to pay out dividends. This would mean that the expected ex-dividend ratio should be below 1 when you have a tax on dividends to compensate against this. Therefore, in 1994 when the tax was zero on dividends, the ex-dividend

day effect should be equal to 1 which also is the case in our study. The taxes impact on the price correction is also apparent when we look at the years with tax on dividends. If we add a 30 % tax on the ex-dividend day ratio we get a price correction closer to 1.

Short-term traders are also more attracted by high dividend yield stock which is apparent when we look at the ex-day ratio for the 30 lowest and 30 highest dividend yields in our data in 1994. For the lowest the ex-day ratio is 0.746 while the highest gives a ratio of 0.993. This shows clear evidence that there is a clientele effect on the ex-dividend day. This is also true when we look at the total sample data and compare the ratio for the 100 stocks that have the highest dividend yield with the 100 stocks that have the lowest dividend yield. The results are then 0.294 for the lowest and 0.840 for the highest. When performing a significance test on the difference between these results, we get a value which shows that they are statistically significant at the 1 per cent level (See table 7). When short-term traders dominate the price on the ex-dividend day, the ex-dividend ratio gets closer to 1 and the arbitrage possibility disappears. When the tax on dividends is the same, the market is instead dominated by long-term traders and then the ex-dividend ratio drops significantly. The ex-dividend ratio in 1997 was very high, which we could not find any explanation for.

Dividend Yield	Average	T-value
100 Highest	0.840	1.007
100 Lowest	0.294	3.667***
t-tests on difference		
t-stat equal	-3.645***	
t-stat unequal	-3.631***	

Table 7: Dividend yields and t-stats on values and on the difference between them.

We can see by the results that taxes do have an effect on the ex-dividend day return. When adding a tax rate of 30 per cent to our results for the years 1995 – 1998 we can see that the results get closer to the results we had for

1994. This shows that the stock market reacts when there is a tax on the dividend and the share price falls by an amount which has deducted the tax. This gives further important evidence of the important role of taxes in the price correction.

5.2 The A-market

The average results for the A-market are based on the figures that are adjusted for the stocks normal return. The model gives an average result of 0.640 and the median value is 0.726. These are also statistically significantly less than unity at the 1 % level (See table 8).

Year	Average	Median	T-value	Wilcoxon
1994	0.725	0.818	1.387	1.061
1995	0.411	0.474	5.591***	5.426***
1996	0.639	0.781	3.545***	3.387***
1997	0.919	0.895	1.522	1.462
1998	0.458	0.724	3.966***	3.424***
1994-1998	0.640	0.726	6.822***	13.575***

Table 8: Adjusted ex-dividend ratio for the A-market.

The A-market resembles the total market and only has a slightly higher ex-dividend ratio and this could be expected since the A-market has most observations and therefore the biggest weight in the total results. By looking at the values on the A-market one can therefore reach the same conclusions, which are that there does exist an arbitrage possibility and an ex-day effect for the period between 1994-1998.

5.3 The O-market

The average results for the O-market show that the model has an ex-dividend ratio of 0.781 and the median is 0.792 (See table 9). These values are also statistically significant at the 1% level but have a much lower t-value than the A- market and total market.

Year	Average	Median	T-value	Wilcoxon
1994	0.615	0.711	1.848*	1.761*
1995	0.718	0.799	2.933***	2.087**
1996	0.767	0.716	1.252	1.633
1997	1.238	1.223	-1.029	-0.921
1998	0.457	0.900	1.862*	1.371
1994-1998	0.781	0.792	2.708***	2.426**

Table 9: Adjusted ex-dividend ratio for the O-market.

The O-market shows a higher correction in the ex-dividend stock price where the stock price fall is larger and more closely follows the dividend amount. This is also the market that had the lowest number of observations and therefore the results show a lower level of significance. The year of 1997 actually had a negative ex-dividend day return where the other markets had a high, but still positive, value. This shows that the stock price actually fell by a larger amount than the dividend during this year.

5.4 The OTC-market

For the shares that were listed on the OTC-market the price adjustment was only 0.443 and the median was 0.476. These results also showed to be 99% significant (See table 10).

Year	Average	Median	T-value	Wilcoxon
1994	0.761	1.222	1.223	0.029
1995	0.386	0.383	1.377	2.260**
1996	0.160	0.479	2.303**	3.285***
1997	0.806	0.646	-0.348	-1.171
1998	0.318	0.505	2.862***	2.264**
1994-1998	0.443	0.476	3.410***	3.887***

Table 10: Adjusted ex-dividend ratio for the OTC-market.

The OTC-market is the market that shows the most profitable trading opportunity on the ex-dividend day. The average price correction was less

than half of the dividend amount for the whole five-year period that this investigation covers. By looking deeper into the figures one can see that the ex-dividend ratio was very low for the years 1995, 1996 and 1998 and higher for 1994 and 1997.

5.5 Comparison between stocks cross-listed in US and not cross-listed stocks

The stocks that are cross-listed in Sweden and US have an average value of 0.638 and the median was 0.788. The significance level was lower for these stocks and showed to be significantly less than unity at the 5% level whereas averages for the different markets as well as the total was at the 1% level. These stocks are compared to the other stocks for the total as well as A-market not including the ones which are cross-listed in US (See table 11).

	Average	Median	T-value	Wilcoxon
Cross-listed 1994-1998	0.638	0.788	2.349**	1.897*
Not cross-listed 1994-1998	0.622	0.715	7.467***	7.884***
Not cross-listed (A) 1994-1998	0.623	0.741	6.190***	6.458***

Table 11: Adjusted ex-dividend ratio for stocks which are cross-listed and not cross-listed.

The values that are compared to each other showed to be very similar and all give a value that indicates a possibility to make arbitrage profits. One can therefore assume that there does not exist a better price correction on stocks listed on both the US market as well as the Swedish market compared to stocks that only are listed in Sweden.

5.6 Ex-day trading profitability

Is it profitable to trade on the ex-dividend effect alone or not? The dividend yield was on average 3% and the price drop, adjusted for the normal return on the ex-day and divided by the stock price on the cum-day, was on average 2.1%. The ratio between percentage price drop and percentage dividend is then $\left(\frac{2.1}{3}\right) = 0.705$. This gives us a return that is $(1 - 0.705) * 3\% = 0.89$ percentage units larger then the normal daily return for our total sample data. On the OTC-market, where we concluded that the largest arbitrage trading possibilities existed, the ex-day return was 1.25 percentage units larger than the normal daily return. The highest abnormal return in our population was 12.32 percentage and the lowest –8.16 percentage (Appendix 3). For the OTC-market the highest abnormal return was 10.91 percentage and the lowest –8.56 (Appendix 3).

This shows that there is an opportunity to make profits on the ex-dividend day. However, the abnormal return is so small that one would have to look for high dividend yielding stock in order to find a return that is large enough to justify the risk. This is also shown to be the case in real life as the correction in the higher dividend yielding stock is much closer to the dividend amount. Since the correction is closer to the dividend, the possibility for a higher return on the investment ceases to exist. Even though transaction costs not have been included in this study they do exist and but they are so small that they usually can be discarded. However, here we have such a small abnormal return that the effect of these costs might have a significant impact. We therefore conclude that it is not profitable to trade only on the ex-dividend day.

5.7 Statistical tests between markets

This section shows the results of the t-tests and Mann-Whitney tests between the stocks listed in both US and Sweden and those listed only in Sweden and also between the different markets on the Stockholm Stock Exchange.

	t-stat, equal	t-stat, unequal	Mann-Whitney, Z-value
Cross-listed – Not Cross-listed	1.843 *	1.180	-0.549
Cross-listed –Not Cross-listed (A)	1.335	0.960	-0.297
A-Other	1.704 *	1.828*	-1.505
A-O	0.898	1.038	-1.362
A-OTC	1.629	1.905*	-1.033
O-Other	0.573	0.649	-1.232
O-OTC	0.577	0.570	-0.614
OTC-Other	1.493	1.755*	-0.670

Table 12: Significance tests between different markets

These tests show the there almost is no difference in the populations between the markets and stocks which are cross-listed and not cross-listed in US.

6. Comparison with Earlier Research

Earlier research that has been performed on the ex-dividend day effect has been discussed before and when comparing this to our findings one can see that there are both similarities and differences in the results that were reached.

Compared to earlier research made on the US stock market, one can see that our results indicated a much lower ex-dividend day ratio than the ones performed by Elton and Gruber (1970) and Kalay (1982). Their results gave a high ex-dividend ratio, which is why they did not see an ex-day effect in their analysis (See table 13). However, as there are different tax laws and dividend payment procedures, it is more interesting to compare our findings with investigations that have been performed on the Swedish stock market.

When looking at the two investigations that have been performed on the Stockholm Stock Exchange their results are quite different. Claesson (1987) found that there was no ex-dividend day effect that could be profitable in her investigation. This study was based on a very small number of stocks and with different economic conditions such as taxes etc. that could explain the very high correction in the stock price (0.960) on the ex-dividend day. The result we reached in our investigation was 0.623. De Ridder and Sörensson (1995) reached a result that indicated a very low ex-dividend day price correction of 0.52 for the A-market and 0.18 for the OTC-market. This showed the opposite from Claesson's findings and our results, which showed a value of 0.640 for the A-market and 0.443 for the OTC-market. De Ridder and Sörensson concluded that there were no differences between the returns on the ex-dividend day before and after the Tax Reform of 1991, but the economic conditions for the years of 1992 – 1993, which were the years after the tax reform that were included in their investigations, were not so good and therefore a very little number of companies paid any dividends at all. These might therefore not represent the true value that the Tax Reform of 1991 had in connection with the arbitrage opportunities on the ex-dividend day. Our results resembled De Ridder and Sörenssons' in the conclusions made upon them that there does exist a possibility to make arbitrage profits on the ex-dividend day but differed regarding the change of taxes which we found to have an effect on

the behaviour of investors and therefore also the stock price on the ex-dividend day.

Author	Adjusted Ex-dividend Ratio
Elton & Gruber (1970)	0.787
Kalay (1982)	0.881
Claesson (1987)	0.960
De Ridder & Sörensson (1995)	0.520
Alm & Arefjäll (1999)	0.623

Table 13: Comparison of the adjusted ex-dividend ratio.

7. Conclusion

This paper has investigated if the price fall in the stock price is the same as the amount of dividend being paid out and if there are any arbitrage possibilities available when this is not the case. We can conclude that there in fact were arbitrage-trading possibilities on the Stockholm Stock Exchange during our studied time period. The price correction has on average been 62.3 percent of the dividend paid out.

The OTC market makes up 23.1 percent of the total population and is the market where the biggest arbitrage possibilities existed. The ex-dividend ratio on the OTC-market was 0.443, which means that the price drop on the ex-day on the OTC market was only 44.3 percent of the dividend paid out. The A-market appears to be similar to the total sample and had an ex-dividend ratio of 0.640, which is not a very surprising result since the A-market represents 60.3 percent of the total population. The last 16.6 percent of the total population consists of the O-market, which shows a price correction that is closer to the dividend than the other markets with an average of 0.781.

We found no significant differences in the ex-day effect for those companies that are cross-listed on both the New York Stock Exchange and

Stockholm's Stock Exchange compared to those only listed on the Stockholm Stock Exchange.

The tax on dividend in 1994 was zero while the capital gain was taxed at the 12.5 percent rate and that attracted short-term traders who determined the price setting on the ex-day and therefore the price fall was closer to the dividend. In 1995 and onward the taxes on dividends and capital gains was set equal and as a consequence the price correction ratio was significantly lower which indicates that the price determination was now dominated by long-term investors who trade on other issues than the dividend. In this case we can then conclude that the tax reform had a significant price influence on the ex-dividend day, which was not the case at the tax reform of 1991 according to De Ridder & Sörensson (1995). 1996 and 1998 also showed a result where the price correction was much lower than the dividend amount while fall in the stock price in 1997 was close to the dividend.

We can also conclude that there was a Clientele Effect on the ex-dividend day in the sense that higher dividend yield stocks attracted more short-term traders than the low dividend yield stocks. We compared the 100 stocks with the highest dividend yield with the 100 stocks with the lowest dividend yield and found a significant difference on the price correction. The stocks with the highest dividend yield had a price drop of 0.840 of the dividend paid out while the stocks with the lowest dividend yield had a price drop of only 0.294. This test was also conducted on 1994 because one can suspect that the zero tax rate on dividend should attract short-term traders or who wants to capitalize on this arbitrage opportunity. These short-term traders would naturally look for the stocks with the highest dividend yield to get the highest possible return on their investments. As suspected we found a similar result here where the higher dividend yield stocks showed a price drop closer to the dividend than the lower dividend yield stocks. These results are consistent with the Clientele Effect discussed by Elton & Gruber (1970) where they argued that investors hold specific

stock portfolios depending on their after tax rates of return. This means that the price correction should change with the dividend yield.

It is difficult to determine whether or not there is a market inefficiency in connection with the ex-dividend day. In order for the market to be inefficient on the ex-dividend day, the results must only depend on the ex-day effect itself and no other issues. As the ex-dividend day in Sweden occurs the day after the share-holders meeting, there might be reactions in the stock price from issues that were brought up at this meeting and not only due to the ex-day effect. We can therefore only conclude that there does exist an ex-day effect on the Stockholm Stock Exchange but we can not be conclusive in the answer on whether or not a market inefficiency is present.

8. Suggestions for further research

Further research could be made to investigate why the ex-dividend ratio is so high in 1997. This year is very different from the other years that follow the change in taxes that was done after 1994 and therefore there should be some economic factors that should explain this deviance. Due to the lack of time when performing our study we have not been able to investigate this issue any further than what is found in our result, namely that there was a return which was out of the ordinary this year.

Another issue that could be considered when performing a future study on the issue of arbitrage opportunities on the ex-dividend day is to look for and try to find the firms' beta values. This would give a better and more accurate adjustment for the normal returns that the stocks provide on the ex-dividend day. This market model adjusted method would not only adjust the stocks included in the study for the return given in the market, but it would also adjust each stock by themselves for how accurately they follow the changes in the total market.

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Eades. M. K., Hess, J. P. & Kim, H. E.	*On interpreting security returns during the ex-dividend period*	Journal of Financial Economics Volume 13, No 1 (March 1984) pp. 3-34

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Grammatikos, T.	*Dividend Stripping, Risk Exposure, and the Effect of the 1984 Tax Reform Act on the Ex-Dividend Day Behavior*	The Journal of Business, Vol. 62, No. 2 (April 1989) pp. 157-174
Grinblatt, S. M., Masulis, W. R. & Titman, S.	*The valuation effects of stock splits and stock dividends*	Journal of Financial Economics Volume 13, No 4 (December 1984) pp. 461-490
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9.3 Internet

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Posten	Postgirots kurslista	http://www.postens.postnet.se/valuta/currency.html
Skattebetalarna	Skattebetalarnas Hemsida	http://www.skattebetalarna.se

9.4 Other

Knopf, John	Seminar	Gothenburg University, (Spring 1999).

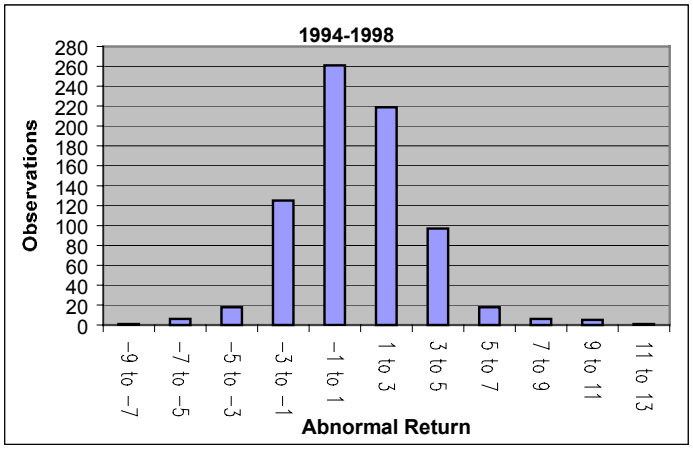
Appendix 1: Observations not found in FT-prices

Companies	Number of Observations
Pharmacia & Upjohn Inc.	8
Autoliv Inc.	4
Nokia AB Oy	3
ADB-Gruppen Mandator AB	1
Föreningssparbanken AB	1
Incentive AB	5
Ticket Travel Group AB	1
BTL AB	1
ZETECO AB	2
Gandalf	1
NK Cityfastigheter AB	1
Euroc AB	3
Garphyttan Industrier AB	4
Hidef Kapital AB	2
HL Display AB	1
KapN AB	1
Skrinet AB	2
Vide Invest AB	1
Abu Garcia AB	1
Exab i Burlöv AB	2
FFNS Gruppen AB	4
Catena AB	3
Vestmanlands Läns Tidning AB	1
The Empire AB	1
ASEA AB	1
Diös AB Anders	1
Sparbanken Sverige AB	2
Arkivator AB	1
Invik & Co AB	1
Total	60

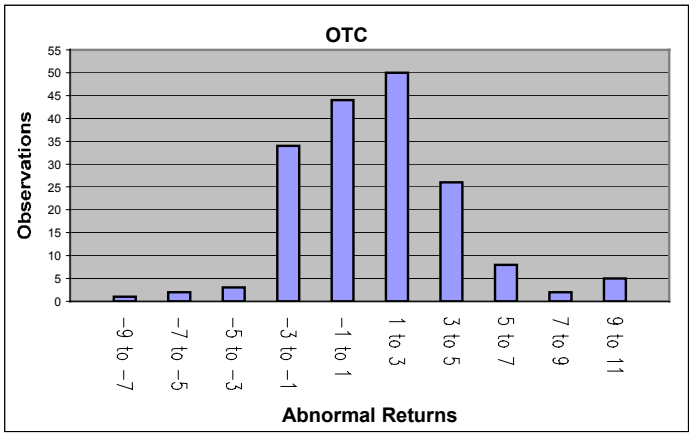
Appendix 2: Swedish stocks listed in US

Company	Listed in USA since
Electrolux	1993
Ericsson	1993
SKF B	1993
Volvo B	1993
ABB	1994
Astra	1994
Astra B	1994
Oxigene	1994
Nokia A	1995
P&U	1996
Sw Match	1996
Autoliv	1997
Biora	1997
Biacore	1997
Netcom	1997
Scania A	1998
Scania B	1998

Appendix 3: Distribution of the Abnormal Returns



The distribution of the abnormal returns between 1994-1998.



The distribution of the abnormal returns on the OTC-market.